CLAIMS

1. An image correction apparatus comprising:

a lens distortion calculation unit which calculates lens distortion correction information with respect to each zoom magnification, based on known images captured at respective different zoom magnifications; and

a memory unit which stores the lens distortion correction information in association with the zoom magnifications.

2. An image correction apparatus comprising:

a memory unit which contains lens distortion correction information in association with zoom magnifications of a lens;

a selector unit which selects lens distortion correction information corresponding to a zoom magnification employed at the time of capturing of an input captured image from the memory unit; and

a distortion correction unit which corrects distortion of the captured image ascribable to capturing based on the lens distortion correction information selected in the selector unit.

3. The image correction apparatus according to claim 2, wherein

the selector unit selects from the memory unit a plurality of candidate pieces of lens distortion correction

information in accordance with the zoom magnification employed

at the time of capturing, and corrects a sequence of sample

points forming a known shape in the captured image by using

each of the plurality of pieces of lens distortion correction

information for error pre-evaluation, and thereby selects one

piece of lens distortion correction information from among the

plurality of pieces of lens distortion correction information.

4. An image correction apparatus comprising:

a lens distortion calculation unit which calculates based

on known images captured at respective different zoom

magnifications a lens distortion correction function for

mapping points on a lens-distorted image onto points on an

image having no lens distortion and a lens distortion

function, that is an approximate inverse function of the lens

distortion correction function, with respect to each lens

magnification; and

a memory unit which stores the pairs of lens distortion

correction functions and lens distortion functions in

association with the zoom magnifications.

5. An image correction apparatus comprising:

a memory unit which contains pairs of lens distortion

correction functions for mapping points on a lens-distorted

image onto points on an image having no lens distortion and

lens distortion functions, that are approximate inverse

functions of the lens distortion correction functions, in association with respective zoom magnifications of a lens;

a selector unit which selects the lens distortion function corresponding to a zoom magnification employed at the time of capturing of an input captured image from the memory unit; and

a distortion correction unit which corrects distortion of the captured image ascribable to capturing based on the lens distortion function selected in the selector unit.

6. The image correction apparatus according to claim 5, wherein

the selector unit selects from the memory unit a plurality of candidate lens distortion correction functions in accordance with the zoom magnification employed at the time of capturing, and corrects a sequence of sample points forming a known shape in the captured image by using each of the plurality of lens distortion correction functions for error pre-evaluation, and thereby selects one of the plurality of lens distortion functions.

7. An image correction apparatus comprising:

a memory unit which contains lens distortion functions for mapping points on an image having no lens distortion onto points in a lens-distorted image in association with respective zoom magnifications of a lens;

a selector unit which selects the lens distortion function corresponding to a zoom magnification employed at the time of capturing of an input captured image from the memory unit;

a perspective distortion calculation unit which calculates a perspective distortion function for mapping points on an image having no perspective distortion onto points on a perspective-distorted image, by using an image whose lens distortion is corrected by the lens distortion function selected; and

a distortion correction unit which corrects distortion of the captured image ascribable to capturing based on the perspective distortion function calculated by the perspective distortion calculation unit.

8. The image correction apparatus according to claim 7, wherein

the selector unit selects from the memory unit a plurality of candidate lens distortion correction functions in accordance with the zoom magnification employed at the time of capturing, and corrects a sequence of sample points forming a known shape in the captured image by using each of the plurality of lens distortion correction functions for error pre-evaluation, and thereby selects one of the plurality of lens distortion functions.

9. An image correction database creating method comprising:

calculating based on known images captured at respective different zoom magnifications a lens distortion correction function for mapping points on a lens-distorted image onto points on an image having no lens distortion and a lens distortion function, that is an approximate inverse function of the lens distortion correction function, with respect to each lens magnification; and

registering the pairs of lens distortion correction functions and lens distortion functions into a database in association with the zoom magnifications.

10. An image correction method comprising:

consulting a database in which pairs of lens distortion correction functions for mapping points in a lens-distorted image onto points in an image having no lens distortion and lens distortion functions, that are approximate inverse functions of the lens distortion correction functions, are registered in association with respective zoom magnifications of a lens, and selecting the lens distortion function corresponding to a zoom magnification employed at the time of capturing of an input captured image; and

correcting distortion of the captured image ascribable to capturing based on the lens distortion function selected in the selecting step.

11. The image correction method according to claim 10, wherein

the correcting of the distortion includes:

mapping a point in a target image having no distortion ascribable to capturing onto a point in a lens-distorted captured image by using the lens distortion function selected which was selected from the image correction database; and

determining a pixel value at the point in the target image by interpolating pixel values near the mapped point in the captured image.

12. The image correction method according to claim 10 or 11, wherein

the selecting of the lens distortion function includes: selecting a plurality of lens distortion correction functions as candidates in accordance with the zoom magnification employed at the time of capturing; correcting a row of sample points having a known shape in the captured image by each of the plurality of lens distortion correction functions for error pre-evaluation; and selecting one from among the plurality of lens distortion functions.

13. An image correction method comprising:

consulting a database in which lens distortion functions for mapping points in an image having no lens distortion onto

points in a lens-distorted image are registered in association with respective zoom magnifications of a lens, and selecting the lens distortion function corresponding to a zoom magnification employed at the time of capturing of an input captured image;

calculating a perspective distortion function for mapping points in an image having no perspective distortion onto points in a perspective-distorted image, by using an image whose lens distortion is corrected by the lens distortion function selected; and

correcting distortion of the captured image ascribable to capturing based on the perspective distortion function calculated.

14. The image correction method according to claim 13, wherein

the correcting of the distortion includes:

mapping a point in a target image having no distortion ascribable to capturing onto a point in a perspective-distorted captured image by using the perspective distortion function calculated; and

determining a pixel value at the point in the target image by interpolating pixel values near the mapped point in the captured image.

15. The image correction method according to claim 13 or

14, wherein

the selecting of the lens distortion function includes: selecting a plurality of lens distortion correction functions as candidates in accordance with the zoom magnification employed at the time of capturing; correcting a row of sample points having a known shape in the captured image by each of the plurality of lens distortion correction functions for error pre-evaluation; and thereby selecting one from among the plurality of lens distortion functions.

16. An information provision apparatus comprising:

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from imaging data obtained by an imaging device;

a distortion detection unit which detects image distortion from the imaging data;

an information data storing unit which stores information data;

a selector unit which selects information data stored in the information data storing unit based on the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and the image distortion detected by the distortion detection unit; and

an output unit which outputs the information data selected by the selector unit to exterior.

17. An information provision apparatus comprising:

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from imaging data obtained by an imaging device;

a distortion detection unit which detects image distortion from the imaging data; an information data storing unit which stores information data;

a selector unit which selects information data stored in the information data storing unit based on the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and the image distortion detected by the distortion detection unit; and

a display unit which displays contents of the information data selected by the selector unit.

18. An image processing apparatus comprising:

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from imaging data obtained by an imaging device;

a distortion detection unit which detects image distortion from the imaging data;

an image data storing unit which stores image data; and

a selector unit which selects image data stored in the image data storing unit based on the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and the image distortion

detected by the distortion detection unit.

19. An image processing apparatus comprising:

a distortion detection unit which detects image distortion from imaging data obtained by an imaging device; a distortion correction unit which corrects the image distortion of the imaging data based on the image distortion detected by the distortion detection unit;

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from the imaging data whose image distortion is corrected by the distortion correction unit;

an image data storing unit which stores image data; and a selector unit which selects image data stored in the image data storing unit based on the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and the image distortion detected by the distortion detection unit.

20. An information terminal comprising:

an imaging unit; a distortion detection unit which detects image distortion from imaging data obtained by the imaging unit;

a distortion correction unit which corrects the image distortion of the imaging data based on the image distortion detected by the distortion detection unit; and

a transmission unit which transmits the imaging data whose image distortion is corrected by the distortion correction unit and information on the image distortion detected by the distortion detection unit to exterior.

21. An image processing comprising:

a reception unit which receives imaging data and information on image distortion transmitted from an information terminal;

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from the imaging data;

an information data storing unit which stores information data; and

a selector unit which selects information data stored in the information data storing unit based on the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and the information on the image distortion received by the reception unit.

22. An information terminal comprising:

an imaging unit;

a distortion detection unit which detects image distortion from imaging data obtained by the imaging unit;

a distortion correction unit which corrects the image distortion of the imaging data based on the image distortion

detected by the distortion detection unit;

an electronic watermark extraction unit which extracts information embedded by electronic watermark technology from the imaging data whose image distortion is corrected by the distortion correction unit; and

a transmission unit which transmits the information embedded by the electronic watermark technology, extracted by the electronic watermark extraction unit, and information on the image distortion detected by the distortion detection unit to exterior.

23. An information database apparatus comprising:

a distortion detection unit which detects image distortion from imaging data obtained by an imaging device;

an information data storing unit which stores information data;

and a selector unit which selects information data stored in the information data storing unit based on the image distortion detected by the distortion detection unit.

24. A data structure to be transmitted from an information terminal having an imaging unit, containing information on image distortion detected from imaging data obtained by the imaging unit.